FIG.1

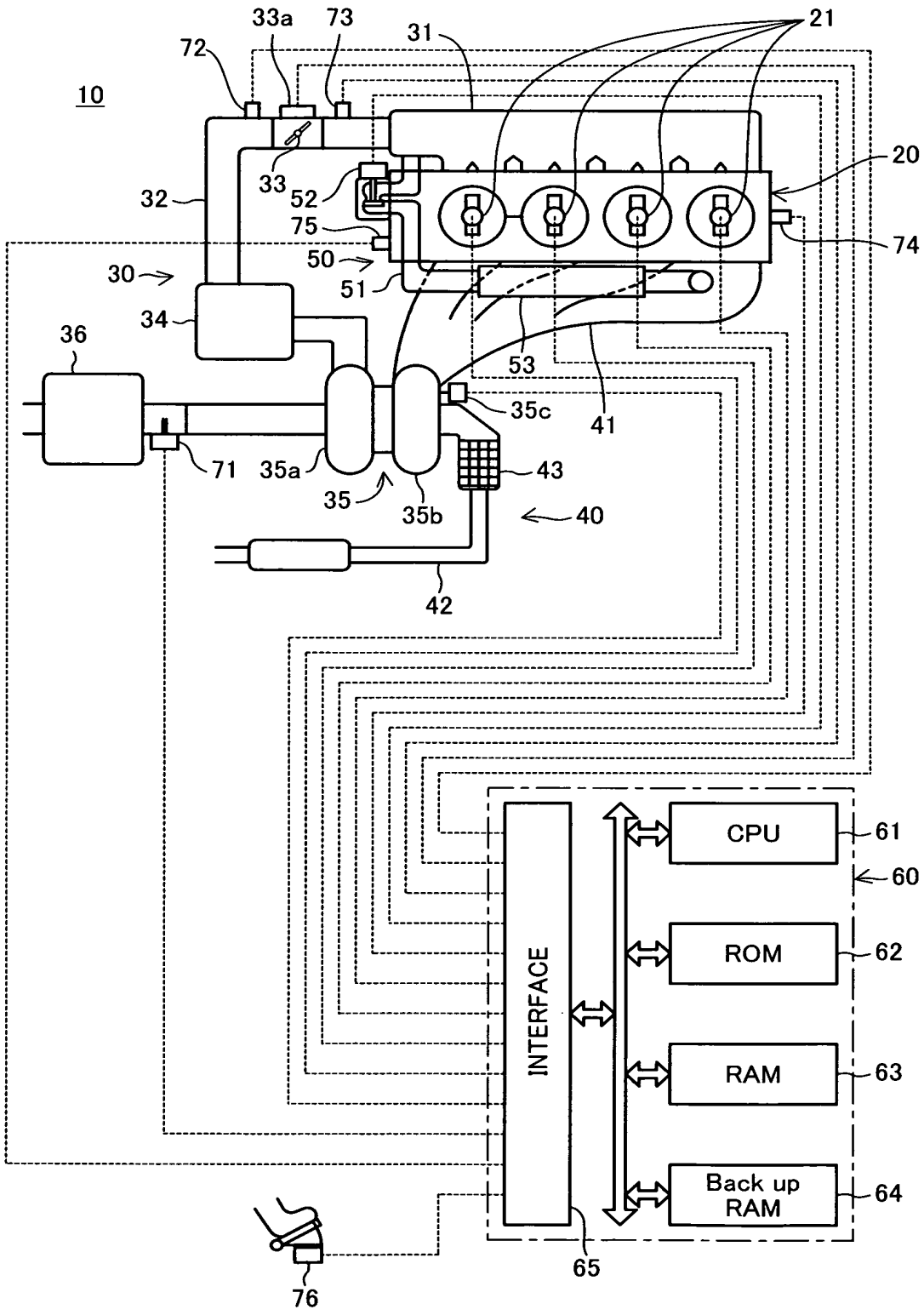

10
33a
73
72
31
21
20
74
32
33
52
75
50
51
30
34
36
53
41
35c
71
35a
43
35
35b
40
42
CPU
61
60
ROM
62
INTERFACE
RAM
63
Back up RAM
64
65
76

FIG.2

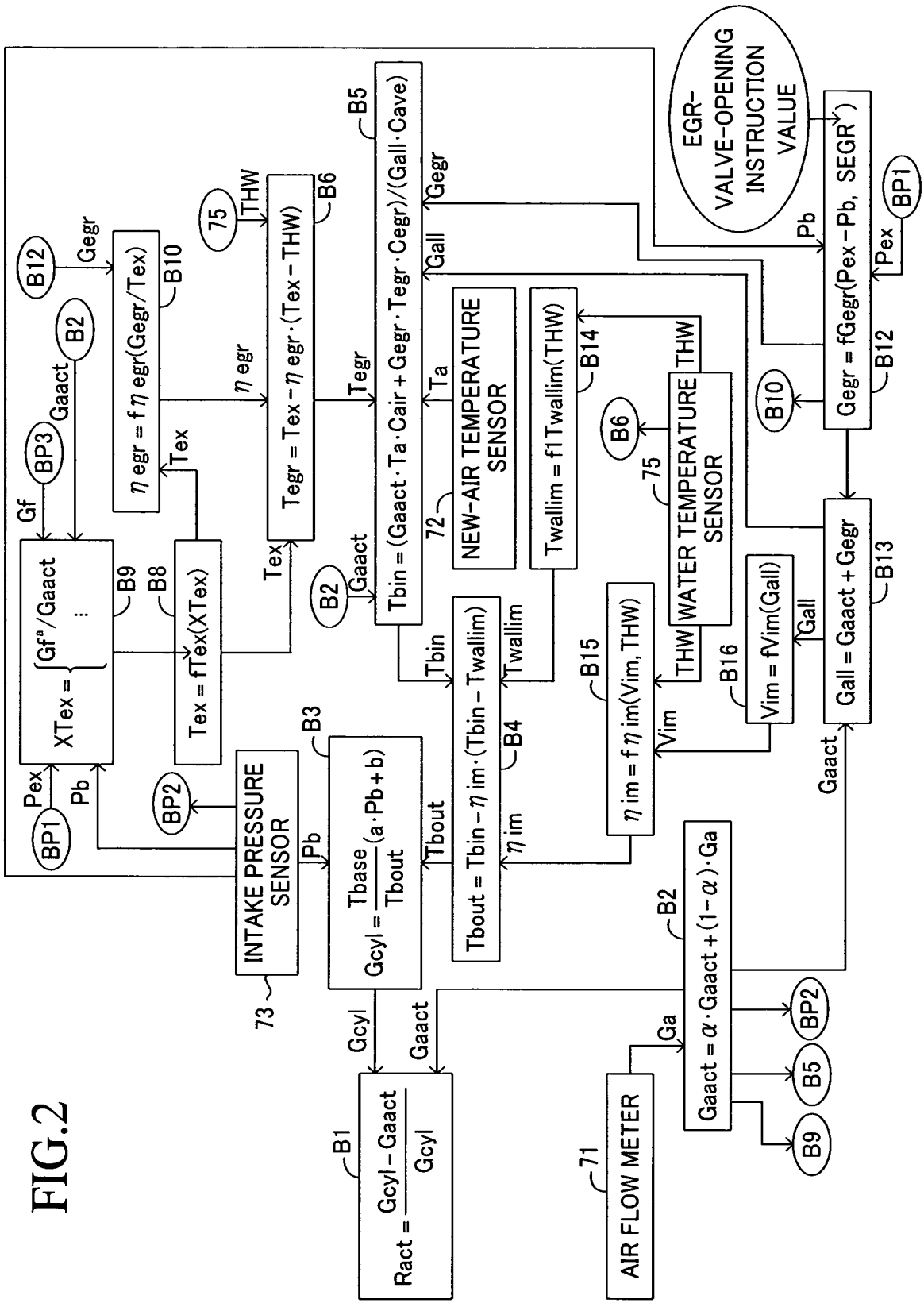

EGR-VALVE-OPENING INSTRUCTION VALUE
Gegr = fGegr(Pex−Pb, SEGR')
Pex
Pb
BP1
B12
B10
B13
Gall = Gaact + Gegr
Gall
Gegr
Gaact
B2
Tbin = (Gaact·Ta·Cair + Gegr·Tegr·Cegr)/(Gall·Cave)
B5
Ta
Tegr
72
NEW-AIR TEMPERATURE SENSOR
Tegr = Tex−η egr·(Tex−THW)
B6
THW
75
η egr
η egr = f η egr(Gegr/Tex)
B10
Tex
B9
B8
XTex = {Gf^a/Gaact ⋮}
Tex = fTex(XTex)
Gf
BP3
BP2
B12
Twallim = f1Twallim(THW)
B14
Twallim
Tbout = Tbin−η im·(Tbin−Twallim)
B4
Tbin
Tbout
η im
η im = f η im(Vim, THW)
B15
Vim
THW
WATER TEMPERATURE SENSOR
B16
Vim = fVim(Gall)
INTAKE PRESSURE SENSOR
73
Pb
B3
Gcyl = Tbase/Tbout (a·Pb+b)
Gcyl
Gaact
B1
Ract = (Gcyl−Gaact)/Gcyl
Gaact = α·Gaact + (1−α)·Ga
B2
Ga
AIR FLOW METER
71
B5
BP2
B9

FIG.3

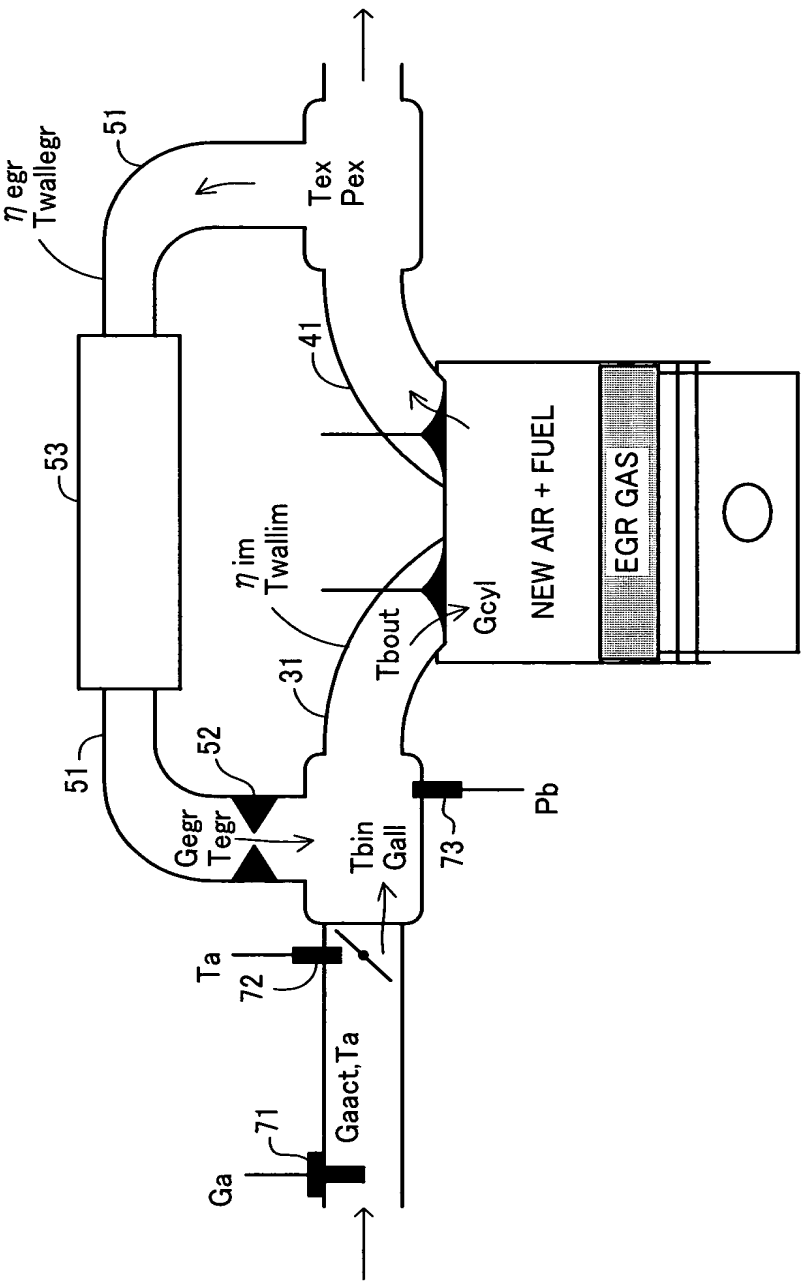

η egr
Twallegr
51
Tex
Pex
41
53
η im
Twallim
NEW AIR + FUEL
EGR GAS
Gcyl
Tbout
31
51
52
Gegr
Tegr
Tbin
Gall
73
Pb
Ta
72
Gaact,Ta
71
Ga

FIG.4

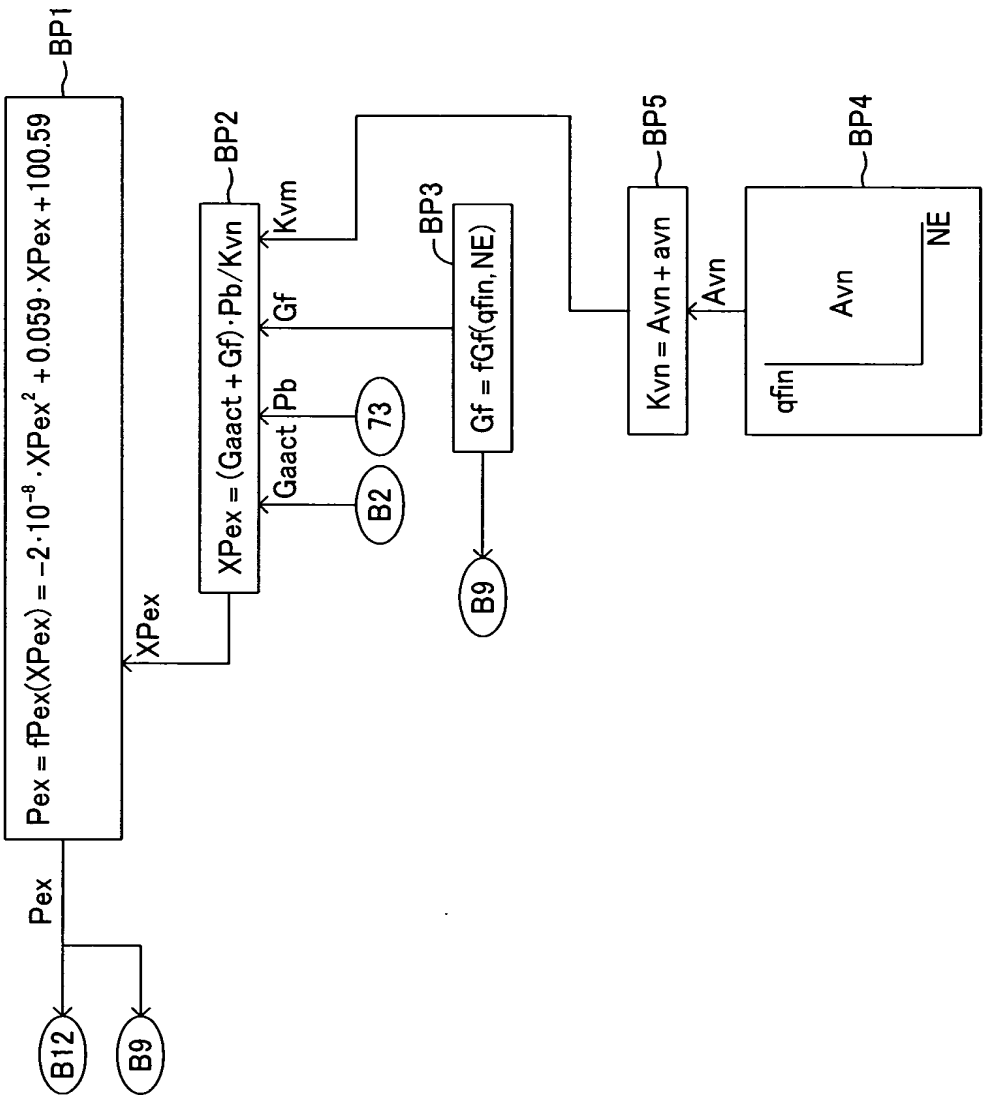
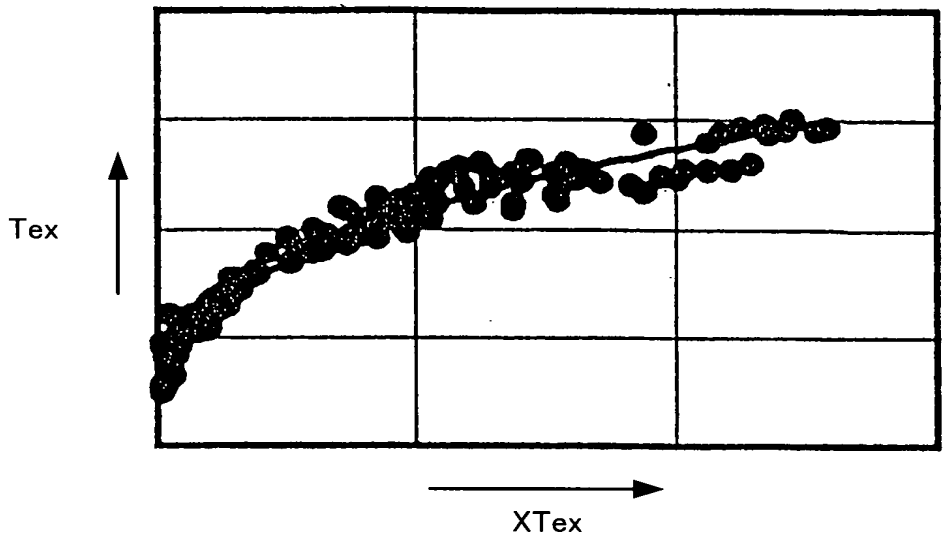
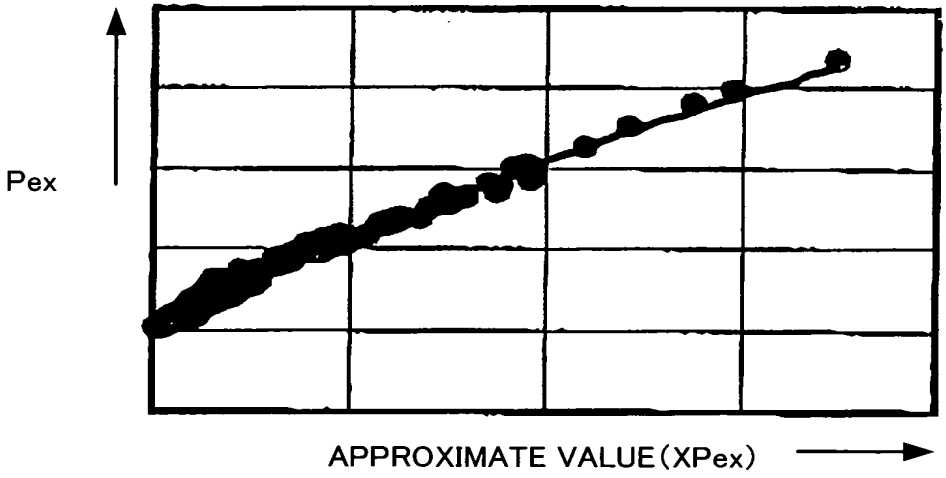

BP1
Pex = fPex(XPex) = −2·10⁻⁸·XPex² + 0.059·XPex + 100.59
XPex
Pex
B12
B9
BP2
XPex = (Gaact + Gf)·Pb/Kvn
Kvm
Gf
Pb
Gaact
73
B2
BP3
Gf = fGf(qfin, NE)
B9
BP5
Kvn = Avn + avn
Avn
BP4
Avn
qfin
NE

FIG.5



$$Tex = fTex(XTex) = 545.9XTex^{0.3489}$$

FIG.6



$$Pex = fPex(XPex) = -2 \cdot 10^{-8} \cdot XPex^2 + 0.0059 \cdot XPex + 100.59$$

FIG.7

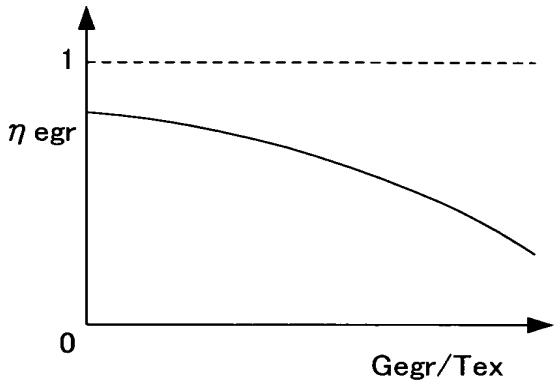

1
η egr
0
Gegr/Tex

FIG.8

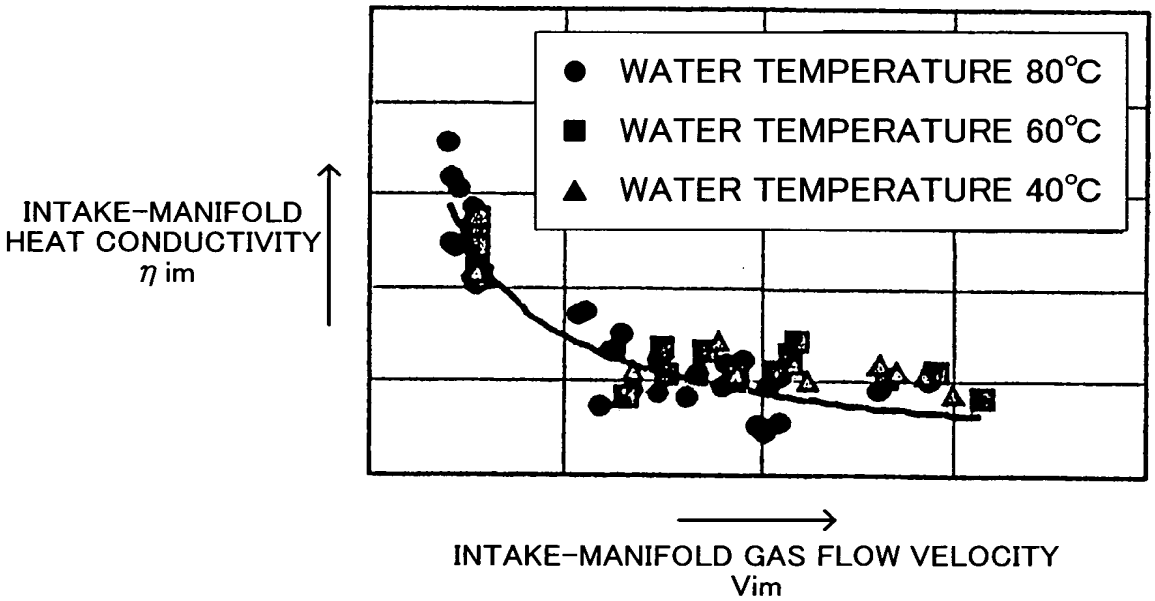

WATER TEMPERATURE 80°C
WATER TEMPERATURE 60°C
WATER TEMPERATURE 40°C
INTAKE-MANIFOLD
HEAT CONDUCTIVITY
η im
INTAKE-MANIFOLD GAS FLOW VELOCITY
Vim

FIG.9

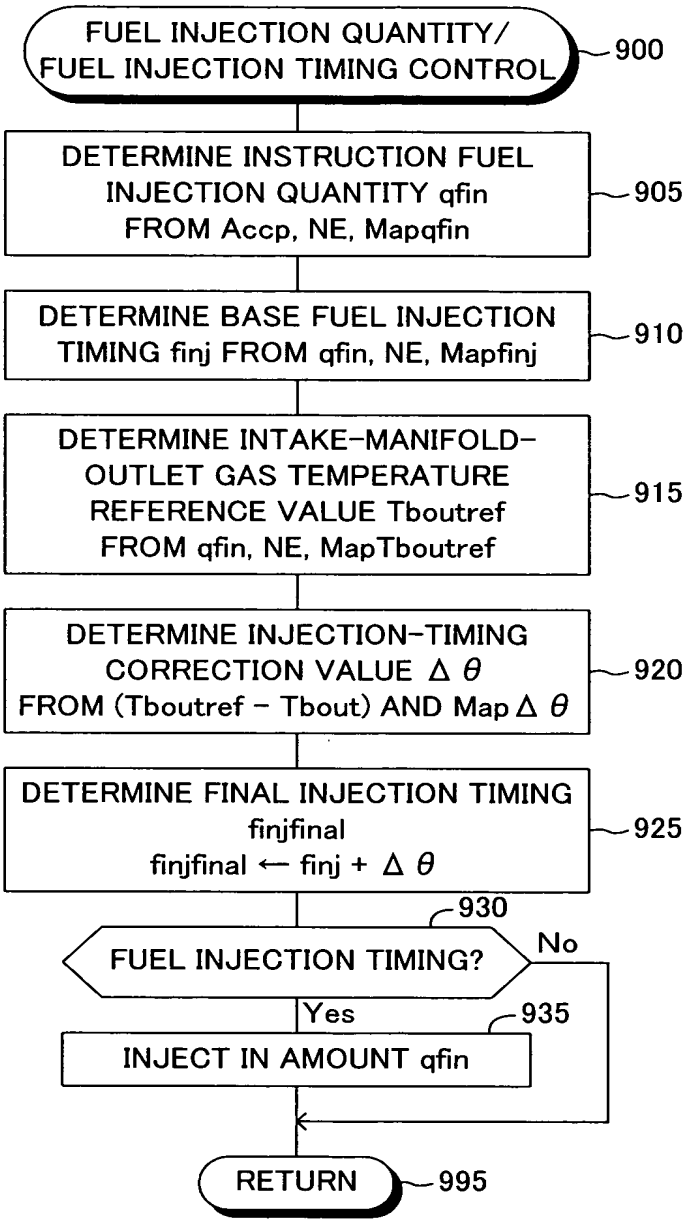

FUEL INJECTION QUANTITY/
FUEL INJECTION TIMING CONTROL
900
DETERMINE INSTRUCTION FUEL INJECTION QUANTITY qfin FROM Accp, NE, Mapqfin
905
DETERMINE BASE FUEL INJECTION TIMING finj FROM qfin, NE, Mapfinj
910
DETERMINE INTAKE-MANIFOLD-OUTLET GAS TEMPERATURE REFERENCE VALUE Tboutref FROM qfin, NE, MapTboutref
915
DETERMINE INJECTION-TIMING CORRECTION VALUE Δ θ FROM (Tboutref - Tbout) AND Map Δ θ
920
DETERMINE FINAL INJECTION TIMING finjfinal
finjfinal ← finj + Δ θ
925
930
FUEL INJECTION TIMING?
No
Yes
935
INJECT IN AMOUNT qfin
RETURN
995

FIG.10

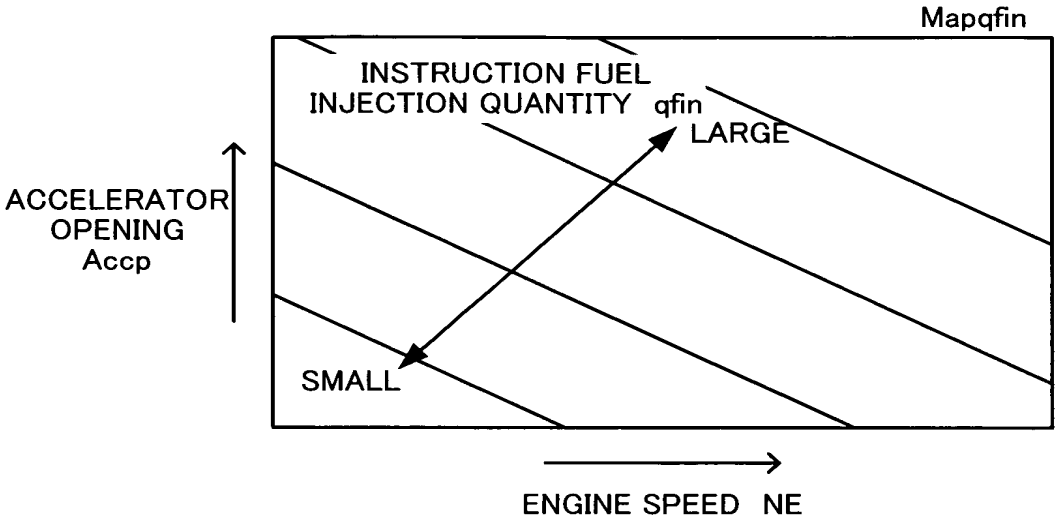

Mapqfin
INSTRUCTION FUEL
INJECTION QUANTITY qfin
LARGE
SMALL
ACCELERATOR
OPENING
Accp
ENGINE SPEED NE

FIG.11

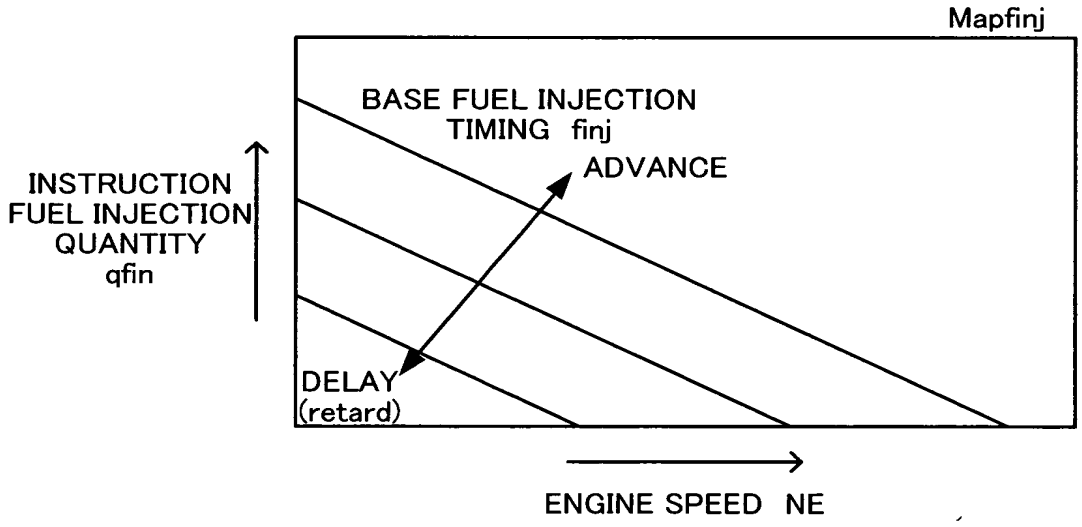

Mapfinj
BASE FUEL INJECTION
TIMING finj
ADVANCE
DELAY
(retard)
INSTRUCTION
FUEL INJECTION
QUANTITY
qfin
ENGINE SPEED NE

FIG.12

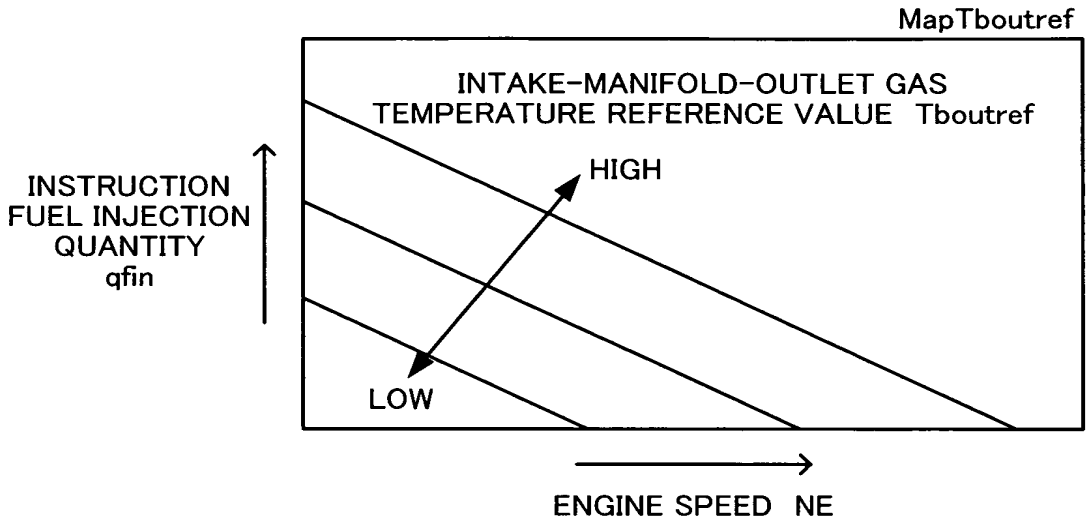

MapTboutref
INTAKE-MANIFOLD-OUTLET GAS
TEMPERATURE REFERENCE VALUE Tboutref
HIGH
LOW
INSTRUCTION
FUEL INJECTION
QUANTITY
qfin
ENGINE SPEED NE

FIG.13

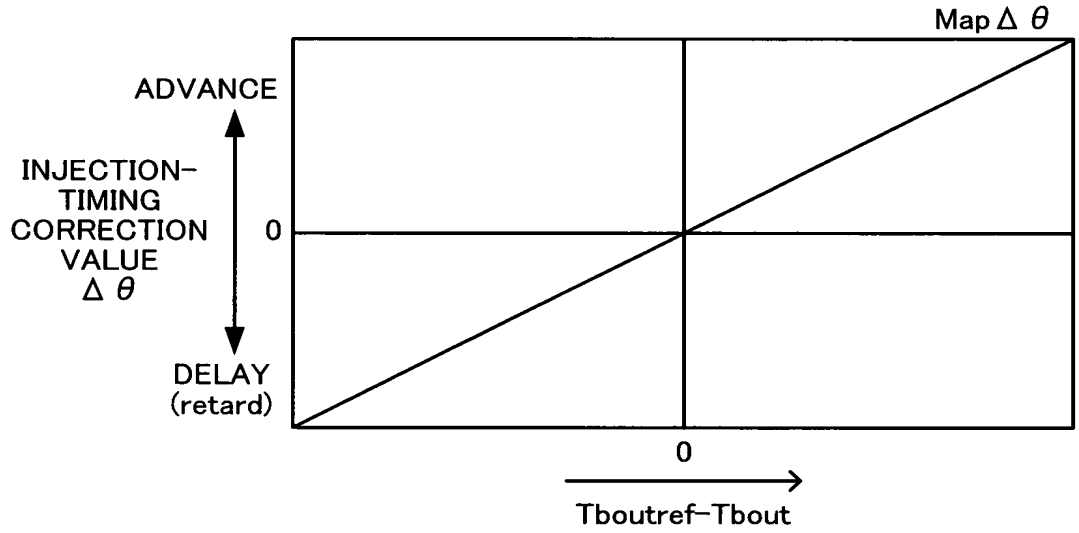

Map Δ θ
ADVANCE
INJECTION-
TIMING
CORRECTION
VALUE
Δ θ
0
DELAY
(retard)
0
Tboutref-Tbout

FIG.14

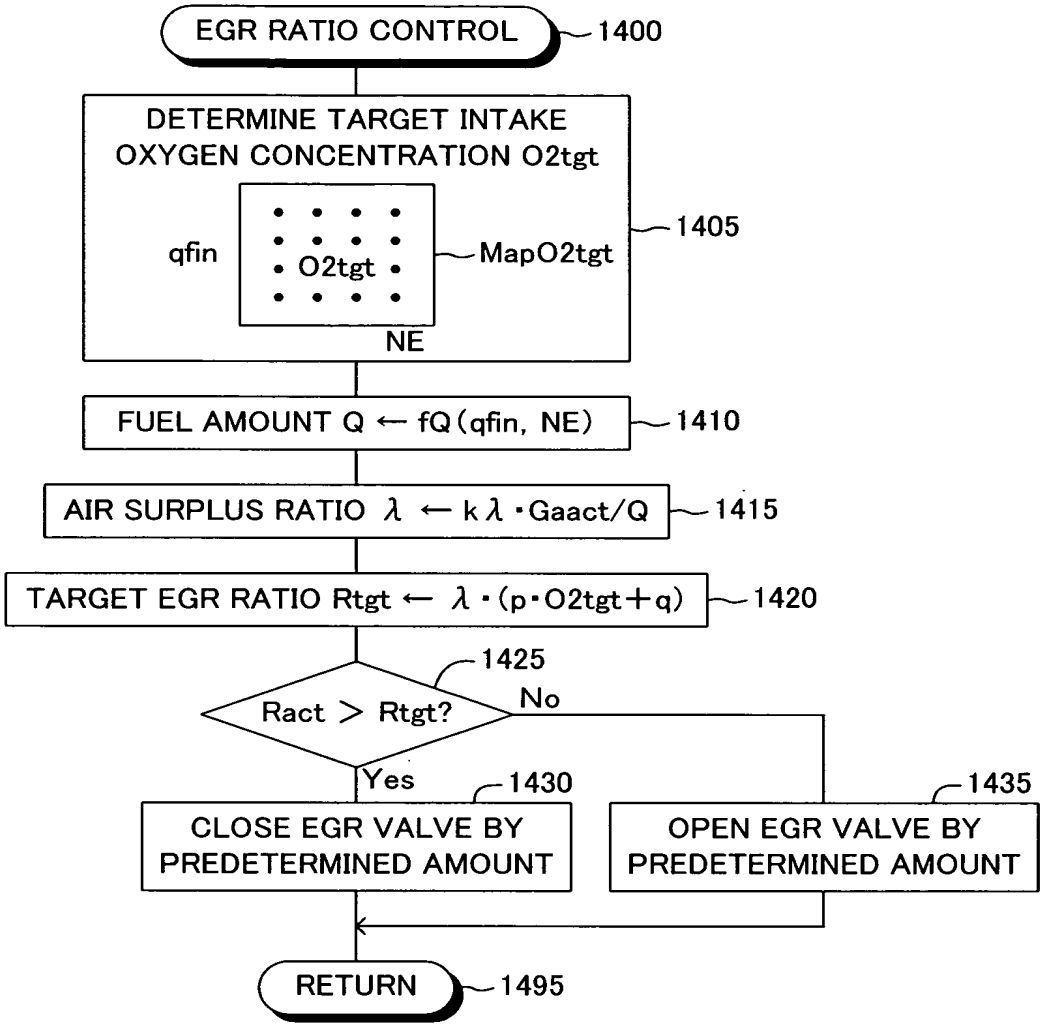

EGR RATIO CONTROL
1400
DETERMINE TARGET INTAKE OXYGEN CONCENTRATION O2tgt
qfin
O2tgt
MapO2tgt
NE
1405
FUEL AMOUNT Q ← fQ(qfin, NE)
1410
AIR SURPLUS RATIO λ ← kλ・Gaact/Q
1415
TARGET EGR RATIO Rtgt ← λ・(p・O2tgt+q)
1420
1425
Ract > Rtgt?
No
Yes
1430
CLOSE EGR VALVE BY PREDETERMINED AMOUNT
1435
OPEN EGR VALVE BY PREDETERMINED AMOUNT
RETURN
1495

FIG.15

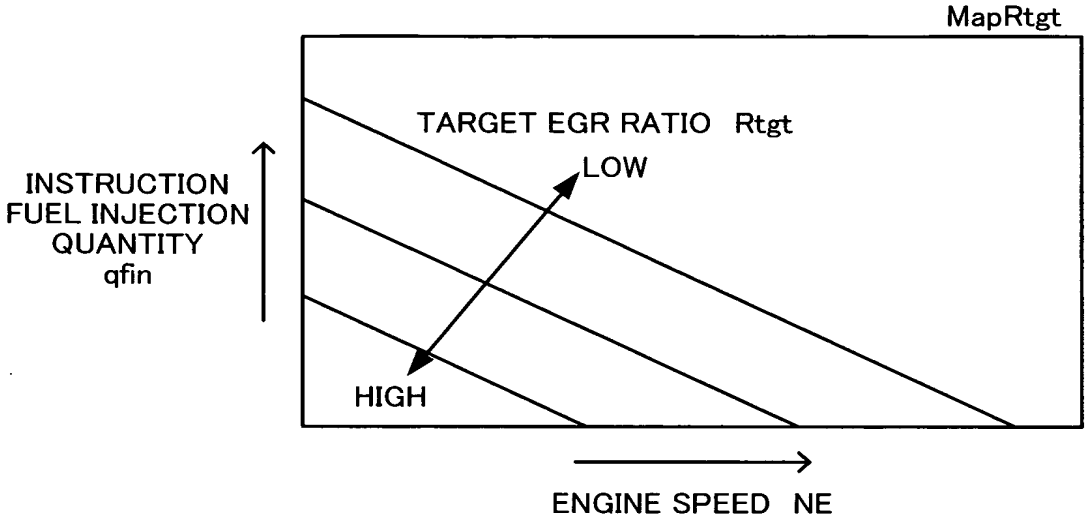
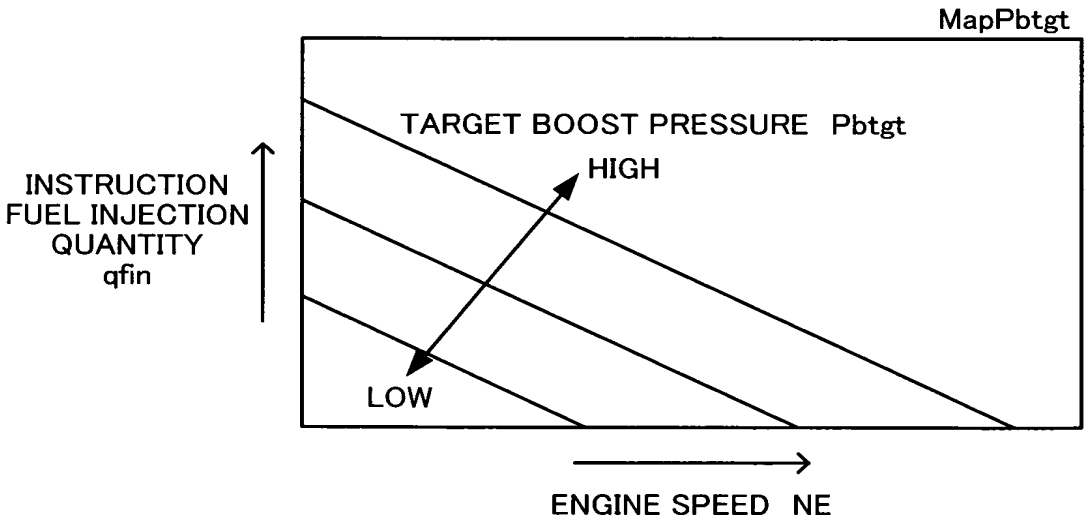

MapRtgt
TARGET EGR RATIO Rtgt
LOW
HIGH
INSTRUCTION
FUEL INJECTION
QUANTITY
qfin
ENGINE SPEED NE

FIG.16


MapPbtgt
TARGET BOOST PRESSURE Pbtgt
HIGH
LOW
INSTRUCTION
FUEL INJECTION
QUANTITY
qfin
ENGINE SPEED NE

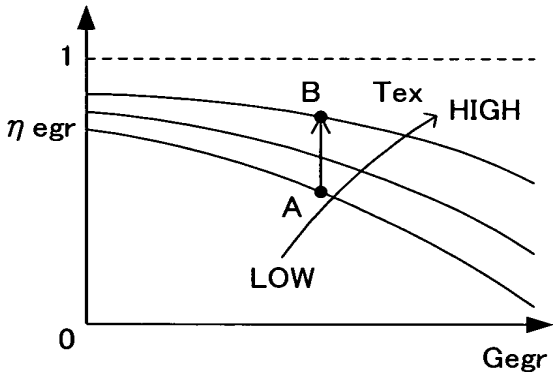



FIG.17